

collected by its respective objective lens and converted into a beam of parallel or near parallel rays, the objective lenses are arranged so that the axes of all the beams issuing therefrom are parallel and spaced apart, and the beams are focused by a focusing lens through a single point and collected beyond that point by detector lens means which serves to reconstitute the parallel beams for presentation to the detector array, wherein optical discrimination between fluorescence emanating from upstream and downstream regions of the micro-samples is improved by a pinhole aperture located at the focal point of the focusing lens so that light which is not emanating from the focal point of each of the objective lenses adjacent the micro-sample sites will be out of focus at the small aperture pinhole.

34. A method according to claim 33, wherein the axes of the objectives are angled with appropriate adjustment of the optical characteristics of the objectives and/or downstream optical system.
35. A method according to claim 33, wherein a single focusing lens is employed for directing all the beam paths through the single point.
36. A method according to claim 33, wherein, the micro-samples are positioned relative to the micro-sample objective lenses so that the region of interest is as close as possible to the focal point of the respective objective lens.
37. A method according to claim 33, wherein the samples are located on a planar support with the regions of interest all in the same plane so that the objective lenses can likewise all be in the same plane parallel to that containing the regions of interest in the samples.
38. A method according to claim 33, including the step of adjusting the position of the micro-sample array relative to the lens array and also

the step of individually adjusting the position of at least the objective lenses relative to the micro-samples or vice versa to ensure that the regions of interest in the micro-samples are at the focal point of the respective micro-sample objective lenses.

39. A method according to claim 33, wherein in order to provide spectral separation based on wavelength, a filter is included in the light path either between the micro-sample objective lenses and the focusing lens means ahead of the pinhole, or between the detector lens and the detector array.
40. A method according to claim 39, wherein the spectral filter is located in a region in which the light paths are parallel or nearly parallel.
41. A method according to claim 33, according to which where fluorescence is the mechanism which generates the radiation which is to be focused onto a detector, excitation radiation to produce the fluorescence is applied only to a region of interest within each micro-sample rather than over the whole of the micro-sample.
42. A method according to claim 41, wherein excitation radiation is injected into the multipath optical system so as to proceed in a parallel sense towards the array of objective lenses, in an opposite sense to the light which emanates from the micro-samples, so as to be focused by the objective lenses onto the region of interest in each micro-sample.
43. A method according to claim 42, wherein the excitation radiation is injected as a parallel beam into the optical path, at right angles thereto, and a 45° beam splitting device is provided onto which the parallel excitation radiation is incident and from which it is directed in a parallel manner towards the micro-sample imaging lenses, but through which radiation from the micro-samples can pass to the focusing lens.

44. A method according to claim 33, wherein excitation radiation is produced using a laser such as an argon ion laser, and a beam expander is employed to expand the cross-section of the laser beam into a relatively large area beam equivalent to the area of the parallel array of micro-sample objective lenses.
45. A method according to claim 33, having an 8 x 12 array of micro-sample objective lenses on the same 8 x 12 matrix as a standard 96 well plate, and if the imaging system is to be used to inspect for example a 384 well plate, the latter is mounted on an XY stage so that it can be moved relative to the array of objective lenses in manner known per se so as to present groups of 96 wells making up the 384 wells, to the 96 lens array.
46. A method according to claim 33, wherein the parallel beams of light directed towards the detector array are transferred to the said array via optical fibres, in the form of a fibre optic bundle or fibre optic plate.
47. A method according to claim 33, wherein the detector array is a charge coupled device having a large number of separately addressable regions each of which is commonly referred to as a pixel, and groups of adjacent pixels or individual pixels from the detector for each sample are addressed, to enable good resolution to be obtained in the XY sense as between the light from one sample and another.
48. A method according to claim 47, wherein the charge coupled device is cooled, for example cryogenically.

49. A method according to claim 33, wherein the detector array comprises an array of photomultipliers, one photomultiplier for each of the channels (optical paths).
50. A method according to claim 49, wherein optical fibres or bundles forming cables are employed to convey the light from each of the apertures in a mask to the windows of photo-multipliers which together occupy an area considerably greater than that of the mask.
51. A method according to claim 49, wherein the photomultipliers are replaced by an image intensifier or an intensified CCD.
52. A method according to claim 49, wherein the photomultiplier tubes, image intensifiers and intensified CCD arrangements are gated electronically so as to enable the delays and short integration periods to be generated as required by time resolved fluorescence or luminescence applications.
53. A method according to claim 33, wherein further lenses for focusing the parallel beams of light directed towards the detector array are employed to improve resolution at the detector surface either in combination with a fibre optic transfer bundle, or otherwise.
54. A method according to claim 33, wherein micro lenses, optionally in combination with a fibre optic transfer plate are employed in the objective lenses adjacent the micro-samples.
55. A method according to claim 54, in which micro lenses have one infinite conjugate.
56. A method according to 33, wherein where a filter is located ahead of the detector, apertured masks are placed on either side of the filter to

collimate the parallel beam to further reduce background and cross-talk.

57. Apparatus for imaging a plurality of micro-sample light emitting sites simultaneously onto separately addressable detectors, comprising means for supporting a micro-sample array on a substrate in close proximity but parallel to an array of micro lenses arranged so as to correspond on a one to one basis with the positions and spacing of at least some of the micro-samples on the substrate, each of the micro lenses being positioned relative to a region of its related micro-sample by a distance equal to the focal length of the lens so that light emitted from that region of the micro-sample will emerge from the lens as a parallel beam parallel to the axis of the lens, and the parallel beams of light are focused by means of a single focusing lens through a pinhole aperture onto a detector lens so as to produce an image of the micro-sample light emissions in the plane of an array of individually addressable photoelectric detectors, such as regions of an addressable CCD array, and circuit means is provided to which signals read out from the array are supplied in the form of a sequence of digital values or otherwise, each corresponding to the light incident on a region of the detector for a given period of time from one of the micro-samples, and computing and analysing circuit means is provided, responsive to the electrical signals, together with memory means for storing data indicative of the light found to be emitted from each of the micro-samples, for storing those values together with address information, whereby each stored value can be identified with the micro-sample on the substrate from which the light giving that value has been emitted by reference to the position of the region in the detector array and by correlating the position of the sample in the sample array.
58. Apparatus according to claim 57, further including a beam splitter, such as a dichroic mirror, interposed in the optical path between the

micro lenses and the focusing lens to enable on the one hand light to pass from the lenses to the focusing lens, and on the other hand to enable excitation radiation, typically light of a particular wavelength, to be reflected as a parallel beam towards the micro lenses, thereby utilising the optical focusing characteristics of the micro lenses to focus the parallel light into spots of light which register with the micro-samples so that the latter are individually radiated by excitation light which is predominantly incident on that region of each micro-sample which is to be inspected for fluorescence after the excitation radiation has been removed, and filter means provided in the optical path between the beam splitter and the detector array to generally attenuate any excitation wavelength radiation travelling towards the detector and generally prevent such radiation from reaching the detector.

59. Apparatus according to claim 57, including a laser source as the source of excitation radiation a beam expander for enlarging the cross-section of the laser beam and presenting a generally uniform parallel beam of excitation radiation for entry into the imaging system via the beam splitter or dichroic mirror.
60. Apparatus according to claim 57, including shutter means to inhibit the passage of the source light, except when required for excitation purposes, and further shutter means synchronised with that associated with the source to prevent light of any wavelength reaching the detector whilst excitation light is projected into the system.
61. A method of analysing fluorescence emitted by radiation excited samples in an array of samples comprising the steps of focusing light emitted from each said sample at infinity so as to form a parallel beam, in parallel with the light from all of the other sample sites making up the array, subsequently focusing all the parallel light paths

62. The method according to claim 61, further comprising the step of introducing periodically into the optical system excitation wavelength illumination and projecting same through the optical imaging devices associated with the array of samples to project the excitation illumination onto a specific region in each said sample, thereafter extinguishing the excitation wavelength light and enabling fluorescence caused by the excitation to pass through the same optical devices to emerge as parallel rays of light for transfer to a detector, for analysis as above mentioned.
63. The method according to claim 61, wherein the objectives are arranged above or below a sample array.
64. The method according to claim 61, when used to perform immediate fluorescence analysis or time resolved fluorescence analysis in which a shutter is provided to inhibit the transfer of light to the detector, excitation radiation is supplied for a short interval of time and then shut off either by pulsing the source out using further shutter or both, after a selected interval of time the shutter preventing transfer of light